



Multibody drivetrain model used for predicting gear tooth stresses in a planetary gearbox

Jørgensen, Martin Felix

Publication date:
2013

[Link back to DTU Orbit](#)

Citation (APA):
Jørgensen, M. F. (Author). (2013). Multibody drivetrain model used for predicting gear tooth stresses in a planetary gearbox. Sound/Visual production (digital)

General rights

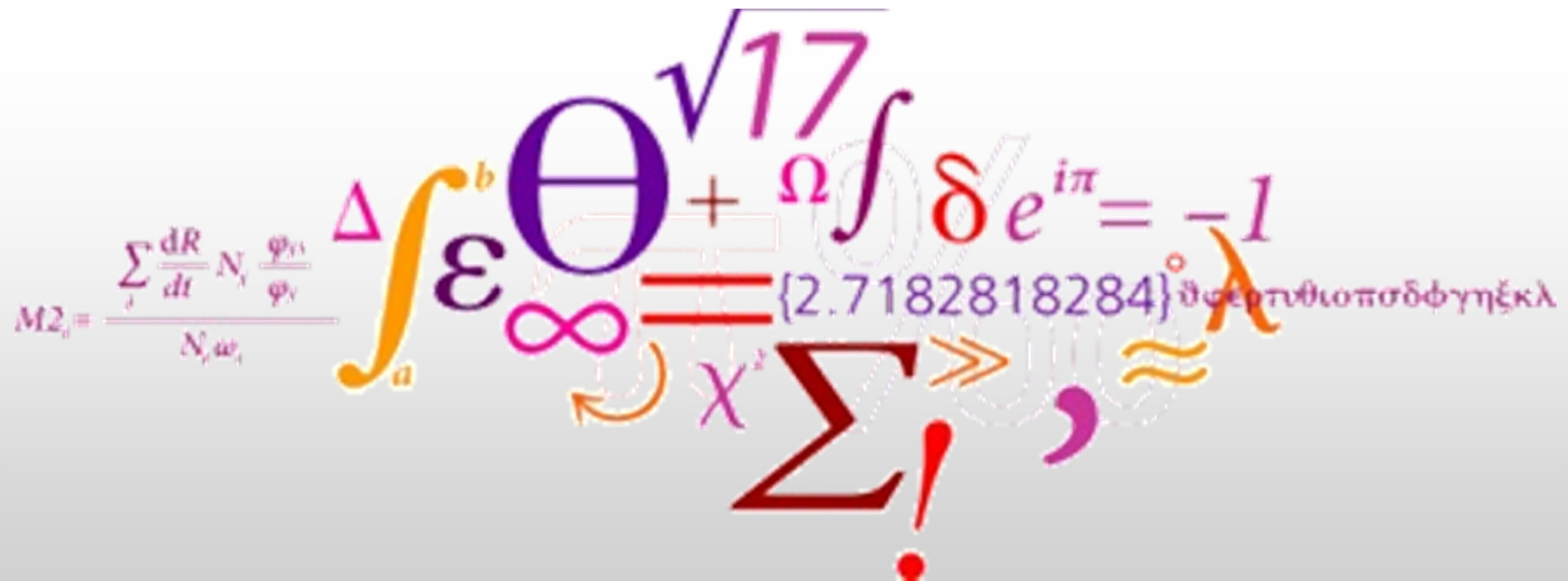
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

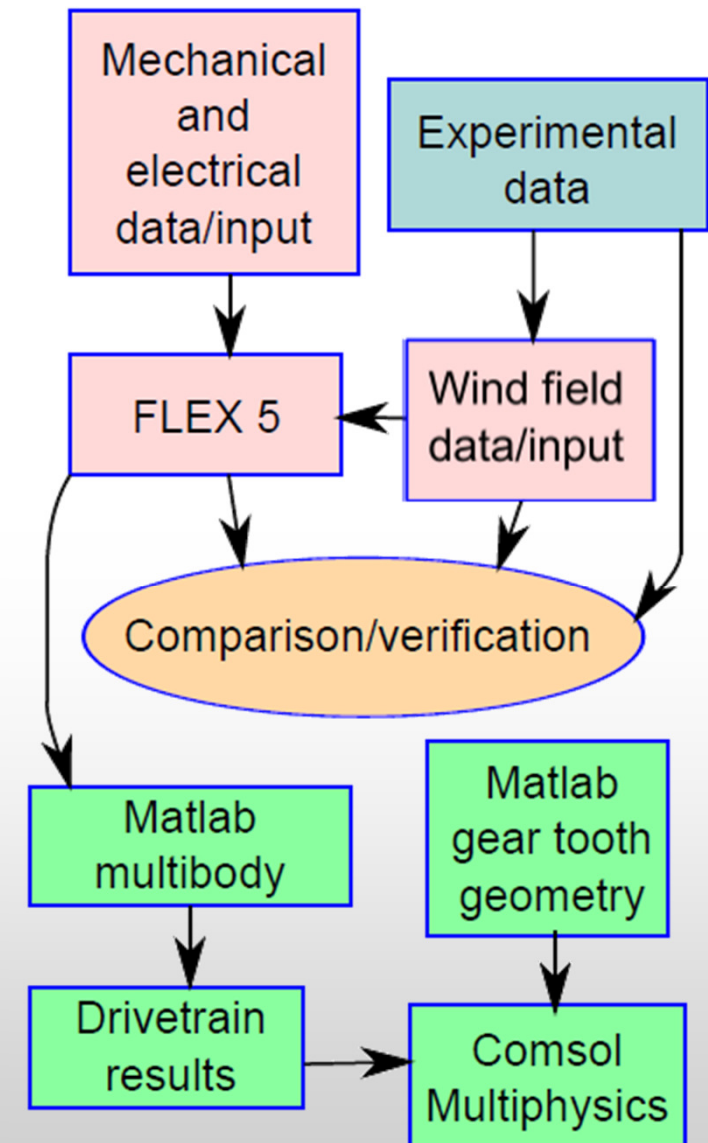
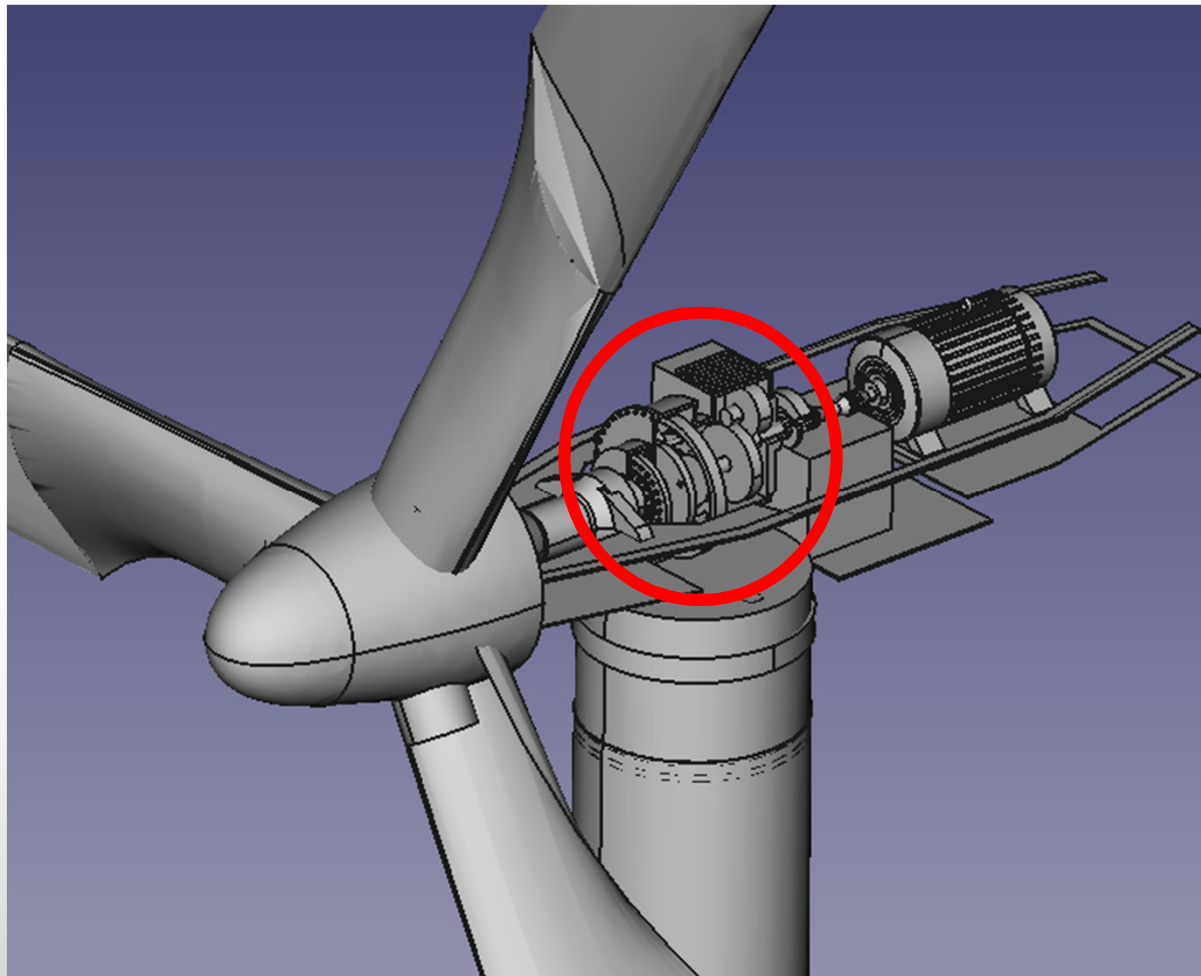
Multibody drivetrain model used for predicting gear tooth stresses in a planetary gearbox

Martin F. Jørgensen, PhD student

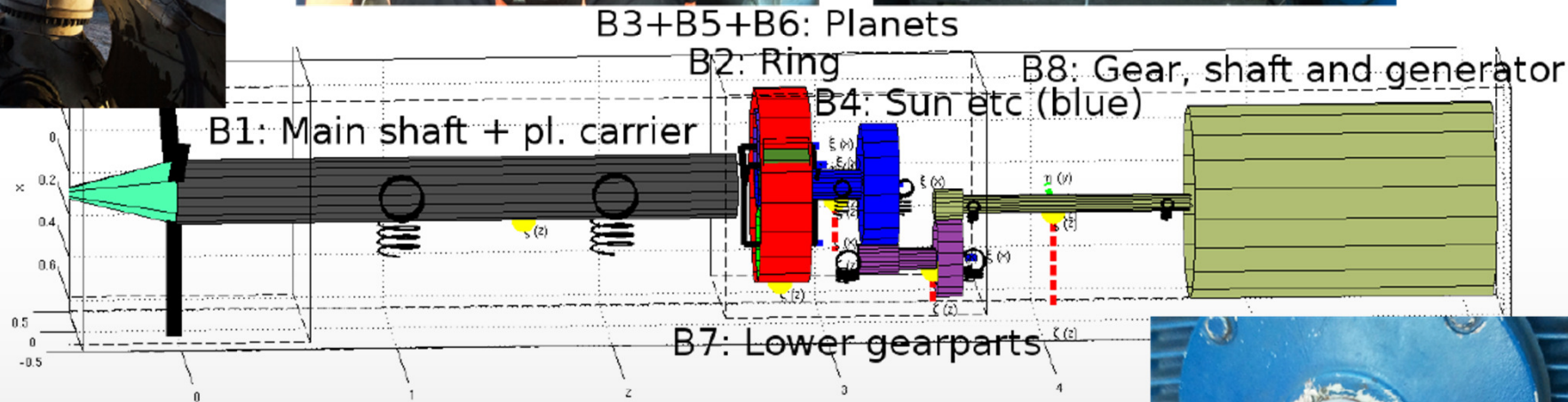
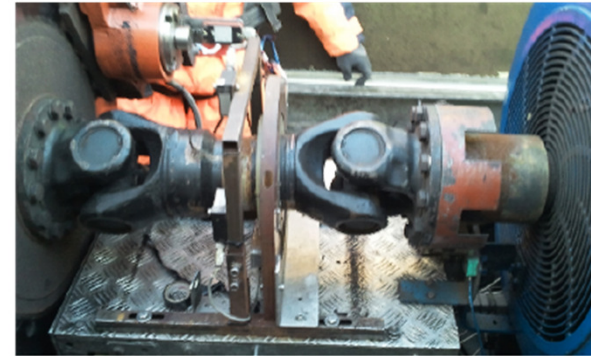
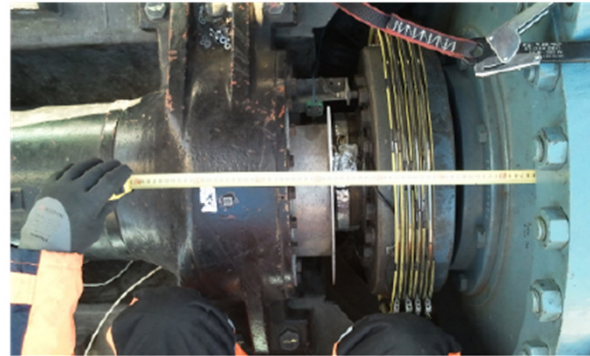


A collage of mathematical symbols and formulas, including integrals, summations, and Greek letters, arranged in a complex, overlapping manner. The symbols include \int , \sum , Θ , ε , Δ , Ω , δ , $e^{i\pi}$, ∞ , χ , λ , \approx , \gg , $!$, and \circ . The background is a light gray gradient.

1. Introduction



2. Multibody Model



3. Equations of motions (constraints)

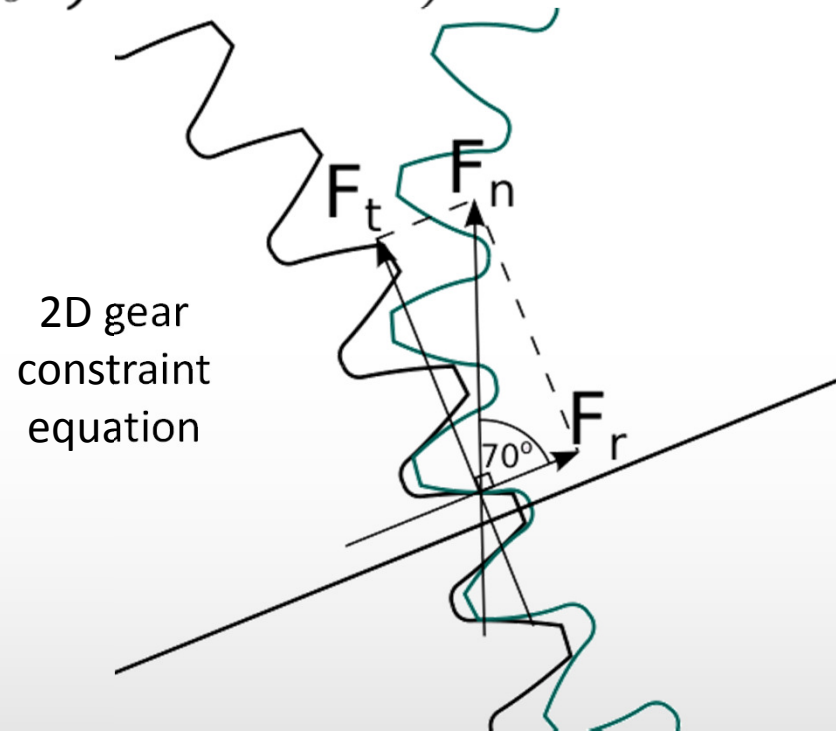
$$\begin{bmatrix} M & \Phi_q^T \\ \Phi_q & 0 \end{bmatrix} \begin{bmatrix} \ddot{q} \\ -\lambda \end{bmatrix} = \begin{bmatrix} g \\ \gamma \end{bmatrix}$$

Reaction forces (in bearings/gear tooth forces etc):

$$M\ddot{q} = \sum F \quad \text{or:} \quad M\ddot{q} = \sum F_{ext} + \sum F_{react} \Rightarrow M\ddot{q} - \underbrace{\Phi_q^T \lambda}_{\text{reaction forces}} = F_{ext}$$

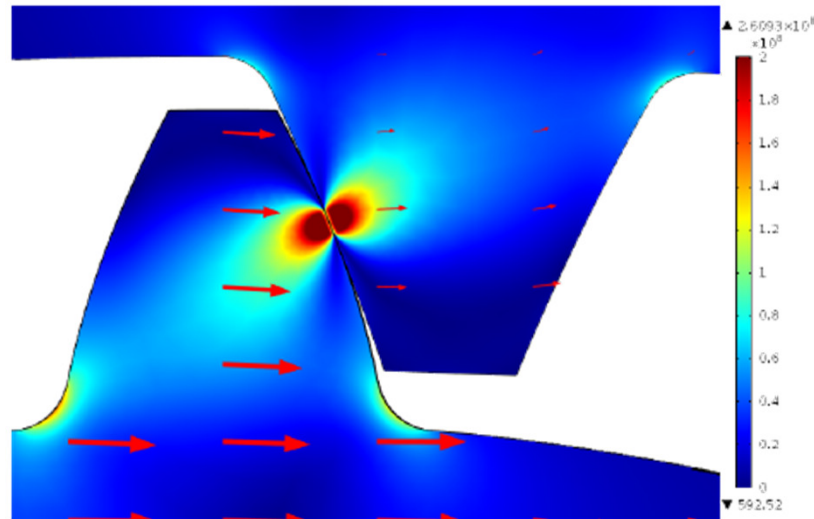
4. Rigid gear constraint (vs. flexible)

$$\dot{\Phi} : (A_{70} \cdot v_r)^T \left(\begin{Bmatrix} \dot{x}_1 \\ \dot{y}_1 \end{Bmatrix} + r_{p1}(\omega_1 \hat{v}_r) \right) - (A_{70} \cdot v_r)^T \left(\begin{Bmatrix} \dot{x}_2 \\ \dot{y}_2 \end{Bmatrix} - r_{p2}(\omega_2 \hat{v}_r) \right) = 0$$

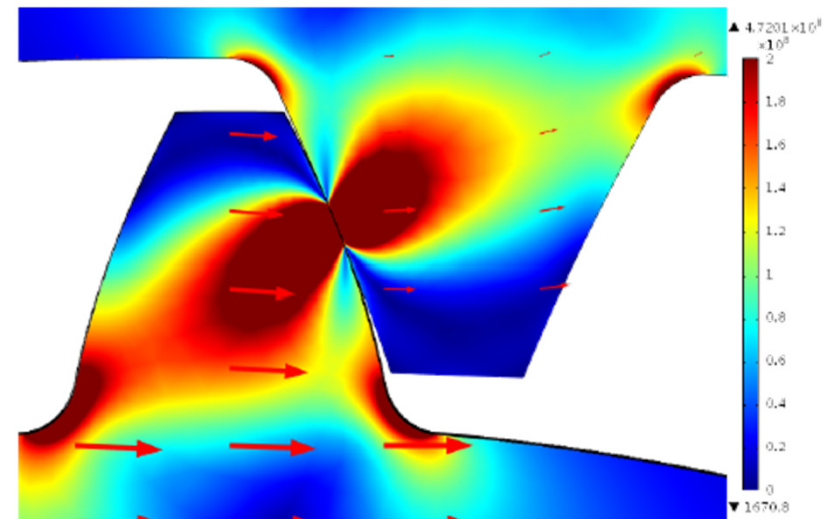


$$\ddot{\Phi} : (A_{70} \cdot \dot{v}_r)^T (\ddot{r}_1 + r_{p1}\dot{\omega}_1 \hat{v}_r) + (A_{70} \cdot v_r)^T (\ddot{r}_1 + r_{p1}\dot{\omega}_1 \hat{v}_r + r_{p1}\omega_1 \dot{\hat{v}}_r) - (A_{70} \cdot \dot{v}_r)^T (\ddot{r}_2 - r_{p2}\dot{\omega}_2 \hat{v}_r) - (A_{70} \cdot v_r)^T (\ddot{r}_2 - r_{p2}\dot{\omega}_2 \hat{v}_r - r_{p2}\omega_2 \dot{\hat{v}}_r) = 0$$

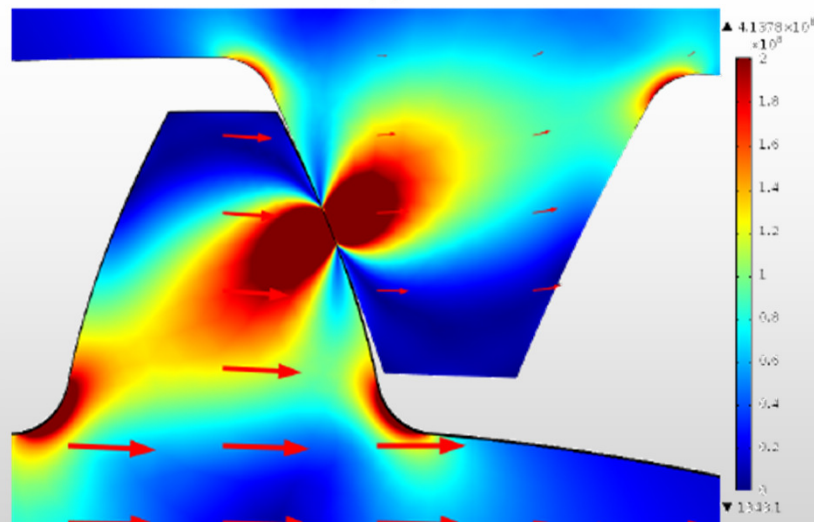
5. Results



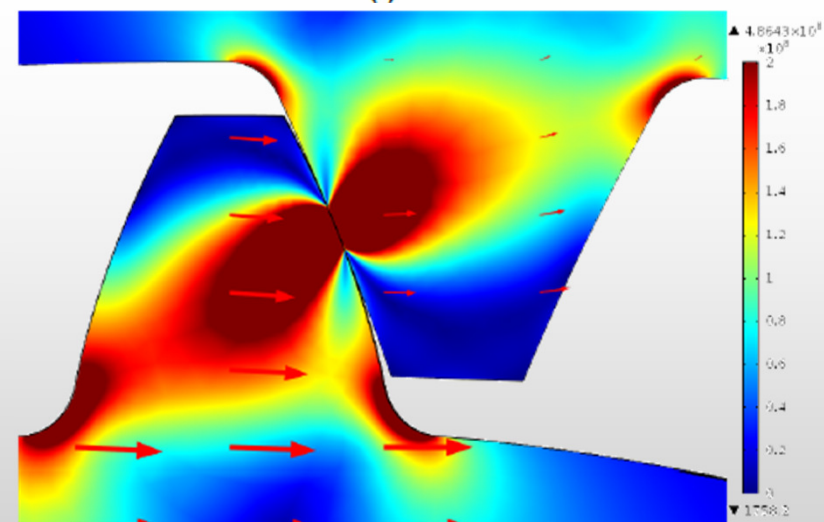
(b) 8 m/s



(f) 16 m/s



(d) 12 m/s



(h) 20 m/s